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A reassessment of carrying capacity estimates for Northeast Pacific herring stocks

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Pacific herring (*Clupea pallasii*) is a large, long-lived and energy-rich forage fish, supporting numerous predators and fisheries in coastal waters from Korea to California. Given the poor current status of many Pacific herring stocks and recent calls for precautionary and ecosystem-based forage fish management, there is a clear need to investigate stock carrying capacities (K) or unfished spawning biomasses (B0). B0 estimates are used to calculate biomass threshold values regulating many herring fisheries. We applied Schaefer and Fox surplus production models to spawning biomass (SB) and adult catch time series to evaluate K (here = SB0) for nine large Pacific herring stocks from Alaska (AK), British Columbia (BC) and California (CA). Monte Carlo resampling from time series was used to generate 95% confidence intervals. Schaefer and Fox model SB0 estimates generally agreed well. Discrepancies between current and previously published Schaefer SB0 estimates, attributable to variable quality of age composition data, were found for some BC stocks. New SB0 estimates for two northern BC stocks exceeded those derived from catch-at-age assessment models, suggesting the latter could underestimate stock depletion. However, overlapping confidence intervals for the outputs of all three model types for all other stocks suggest multi-model inference may be a fruitful approach to herring SB0 estimation and formulation of precautionary fisheries management strategies. Confidence intervals for Schaefer and Fox SB0 estimates did not overlap with those of recent spawning biomass estimates for any BC stocks, strengthening the case for precautionary management.

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Natural and anthropogenic factors in the Guadalquivir estuary affect the abundance of anchovy in the Gulf of Cadiz (SW Spain)

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The Gulf of Cadiz socio-ecosystem is characterized by a focal ecosystem component –the estuary of the Guadalquivir River– that has an influence on the marine ecosystem –serves as a nursery area– and at the same time concentrates a great number of sectoral human activities. This nursery role particularly affects the anchovy fishery, which is the most economically and culturally important fishery in the region. As a transition zone between terrestrial and marine environments, estuaries are particularly sensitive to human activities, either developed directly at the aquatic environment or its surroundings. A dam 110 km upstream from the river mouth regulates freshwater input (mainly for agriculture purposes) into the estuary with consequences on turbidity and salinity. Using time series analysis on 18 years of monthly data from an estuarine monitoring program we (1) quantify the effects that natural (plankton, temperature, winds) and anthropogenic-influenced variables (freshwater volume, turbidity, salinity) have on the abundance of anchovy larvae and juveniles, and (2) relate the abundance of these estuarine- resident early stages to the abundance of adult anchovy in the sea. Water management stands out as a key node where potentially conflicting interests (agriculture, power generation, aquaculture, fisheries) converge. Linking land-based activities to its impact on stock biomass represents the main challenge to ecosystem-based management in this particular regional sea. By focusing on the effects that these activities ultimately have on the anchovy fishery –via recruitment– our study aims to contribute to the process of making the ecosystem approach operational in the Gulf of Cadiz.